

VOLUME 76

SEPARATE No. 46

PROCEEDINGS

AMERICAN SOCIETY
OF
CIVIL ENGINEERS

DECEMBER, 1950



HUMAN ASPECTS OF MEXICAN IRRIGATION

By Antonio Rodríguez Langoné

IRRIGATION DIVISION

*Copyright 1950 by the AMERICAN SOCIETY OF CIVIL ENGINEERS
Printed in the United States of America*

Headquarters of the Society
33 W. 39th St.
New York 18, N.Y.

PRICE \$0.50 PER COPY

Y620.6

*The Society is not responsible for any statement made or opinion expressed
in its publications*

Published at Prince and Lemon Streets, Lancaster, Pa., by the American Society of
Civil Engineers. Editorial and General Offices at 33 West Thirty-ninth Street,
New York 18, N. Y. Reprints from this publication may be made on
condition that the full title of paper, name of author, page
reference, and date of publication by the Society are given.

AMERICAN SOCIETY OF CIVIL ENGINEERS

Founded November 5, 1852

PAPERS

HUMAN ASPECTS OF MEXICAN IRRIGATION

BY ANTONIO RODRÍGUEZ LANGONÉ¹

SYNOPSIS

When more than 90% of a country is deficient in natural water for agriculture, when arable land is badly needed, and when private financing is inadequate or undesirable, the state must shoulder the national burden. Mexico is doing just this, making great progress, especially since 1926. Legislation to meet local needs has been continually revised, particularly to benefit the smaller landowner, but at the same time to eliminate the uneconomical farm of less than 5 hectares. The government runs the large projects; and the water users, the smaller ones, adjusting water distribution and canal maintenance to meet local needs. Continuous repayment of development costs by landowners is a basic policy. Industry as well as agriculture has been greatly benefited, and living conditions have been materially improved.

WHY IRRIGATION IS ESSENTIAL IN MEXICO

Most of Mexico needs irrigation. About 93% of its surface is arid or semi-arid—that is, rainfall is not sufficient for the growth of crops. The agricultural and physical aspects can be divided into three great regions—

(a) The North Zone: In this zone soils and topography are favorable for irrigation but rainfall is scarce and its monthly distribution is inadequate for the growth of crops. Rivers are mostly torrential in character;

(b) The Central Plateau: This area is not suitable for extensive agriculture since the valleys are small with rolling hills and most of the rivers and creeks are torrential. Irregular and insufficient rainfall results in uncertain crop yields;

(c) The Atlantic and Pacific Coastal Plains: These plains have excellent soil and are very attractive for agricultural development. However, sanitary conditions need to be greatly improved in the southern part before serious farming can be undertaken.

NOTE.—Written comments are invited for publication; the last discussion should be submitted by June 1, 1951.

¹Civ. Engr., Director General of Water Development, Ministry of Hydraulic Resources, Mexico, D. F., Mexico.

Although irrigation has been practiced in Mexico since the time of the Aztecs, not until 1926 was a serious irrigation program initiated by the government. Mexican lands can be roughly classified as follows (1 hectare = 0.404687 acres):

Classification	Million hectares	%
Arable land.....	23.4	11.9
Pasture (in flat or rolling country).....	66.5	33.9
Pasture (in mountains or hilly country).....	30.0	15.3
Forests.....	45.0	22.9
Deserts.....	31.5	16.0
Total.....	196.4	100.0

GENERAL POSSIBILITIES

From hydrological studies made by the Ministry of Hydraulic Resources of Mexico it appears that approximately 6,800,000 hectares (16,800,000 acres) can be irrigated through storage dams assuming that the dams can utilize about 80% of the mean stream flow. By adequate use of underground water, 1,000,000 hectares (2,500,000 acres) more could be added to the irrigable area. The addition of an approximate area of 2,000,000 hectares (5,000,000 acres) of land in the humid region where irrigation is not necessary gives a total of 10,000,000 hectares (25,000,000 acres) of land with adequate water supply. As arable lands in Mexico are limited to about 23,400,000 hectares (57,800,000 acres), 13,400,000 hectares (33,100,000 acres) would remain "temporal" (dry farming) lands with the water supply relying on uncertain rainfall.

The area with assured water supply means an area of 0.4 hectare (1 acre) per inhabitant for a population of 25,000,000. A cropping area of 23,400,000 hectares would mean a surface of 0.93 hectare per inhabitant (2.29) acres which is lower than the area of 1.2 hectares (2.9 acres) per inhabitant with adequate water supply in the United States.

AIMS OF MEXICAN IRRIGATION POLICY

Irrigation is necessary in Mexico not only because physical conditions require it, but also because it meets the need for a better distribution of the rural population. In addition, it is one of the best methods of improving the national economy.

Since water is scarce, very careful planning of irrigation projects is imperative. Every drop of water available will be utilized in the proper irrigation, hydroelectric, and multiple-use developments for the benefit of agriculture and industry. The Mexican government believes that irrigation works constitute the "means toward the end" of improving its agriculture and the economy of the rural masses but that the correct interpretation and management of the physical and human aspects involved and the adequate organization and operation of the resulting irrigation districts constitute the final purpose of its irrigation policy.

To this end irrigation projects should be conceived and planned from a sociological viewpoint. From the beginning every step concerning the problem

of supplying water to irrigate the land should be coordinated with the problem of organizing the community that is to settle the land.

ASPECTS OF SETTLING

Mexican Experience Under 1926 Irrigation Law.—To obtain a fair understanding of Mexican experience in relation to settling irrigation districts, two periods should be considered: The initial period covered by the 1926 Irrigation Law and the present (1949) period operating under the law of December, 1946.

On some of the irrigation projects constructed and developed during the initial period, such as the Don Martin project (Fig. 1(a)) in the states of Coahuila and Nuevo León and the Conchos river project in Chihuahua, the land was in the hands of a few large owners; and therefore it was possible to design an adequate system of secondary canals, drains, and roads. On other projects where the land was greatly subdivided, like the Tula project in the State of Hidalgo, the secondary system of water distribution had to be adapted to very irregular and small holdings.

By 1930 many of the irrigation projects were ready for opening and operation. The problem of settling immediately arose. This enterprise, difficult in itself, was made even more troublesome because of inexperience. It was necessary to introduce measures which had not been tried and to issue a series of special rules. Some of these rules had to be tested in the field, and adapted to the social and economic conditions prevailing in the region—in every case efforts were made to obtain the best results. All these measures had, as was to be expected, aspects of both success and failure.

Early settling at the Don Martin and Conchos projects was rather slow; applicants seemed loath to settle the new irrigated lands. Later, however, in 2 years or 3 years, the situation changed entirely; and, ever since, the demand for irrigated land has been so great that it cannot be met.

Several Forms of Contract.—The first type of contract drawn for settlers was called "promise of sale" contract. Under this kind of document the settler had to pay in advance 5% of the total value of the land and the remainder in twenty-five annuities with 4% interest to be computed on the unpaid balance. Original lack of demand for the irrigated land led the National Irrigation Commission to think that poor prospective settlers could not afford the initial 5% payment.

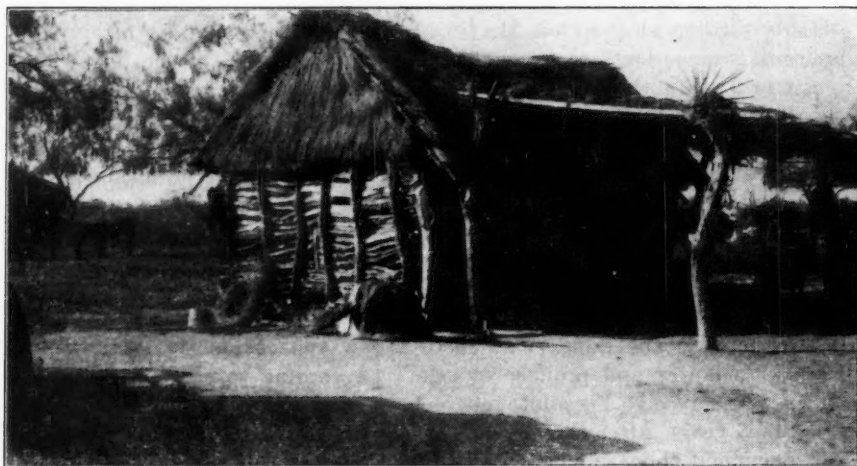
Therefore, in the same year, 1930, a new type of contract was drawn, entitled "tenantry and promise of sale." According to this agreement the farmer would receive his allotment of land in the character of tenant for a period of 3 years. After this period the contract would become a "promise of sale" document obligating him to pay for the land in 20 years with 4% interest on the unpaid balance. The results of this type of contract seemed satisfactory at the start and a great number of settlers was established in irrigation districts. In other irrigation districts which were already settled by original owners, like the Tula District in the State of Hidalgo, no settling problems had to be solved.

Experience showed, by 1932, that this policy for obtaining very rapid settling, together with the lack of an adequate set of regulations, had resulted in serious abuses by applicants and settlers. Drastic changes were necessary

and strict regulations had to be issued specifying prerequisites for applicants, settlers' rights and duties, and various other measures to obtain discipline and to avoid the award of land to people not living within the district who might try to cultivate the property through tenants.



(a) Settlers' New Homes in Don Martin Irrigation District, Coahuila and Nuevo León States



(b) Old Cottage in Lower Rio Bravo District, State of Tamaulipas

FIG. 1.—FEDERAL IRRIGATION HAS IMPROVED LIVING CONDITIONS IN MEXICO

During 1932 three types of contract were established: The "cash down sale," the "sale type A," and the "sale type B" forms. A maximum area of 100 hectares could be brought under the first type mentioned. Also a maximum of 100 hectares could be purchased under the sale type A contract with 5% of

the total value of the land required as a down payment and the remainder to be liquidated in 25 years, with 4% interest to be computed on the unpaid balance. Only 25 hectares could be acquired under the sale type B contract which required no down payment; but the settler had to turn over enough crops to pay for 4% of the total land value every year plus operation charges. In both types A and B contracts no tenancy was permitted.

Later on, after the operation of the irrigation districts was turned over to the National Agricultural Bank, a new type of contract was drawn up under the title of "sale contract with mortgage security."

All these later types of contract have been fairly satisfactory. Still, tenancy has not been entirely abolished and difficulties and delays occur when it becomes necessary to eliminate unsatisfactory settlers through legal procedures.

Settling Experience Under the 1946 Irrigation Law.—In the short period since the 1946 law was issued, the results can hardly be analyzed accurately. The law provides that original landowners with more than 100 hectares have to subdivide the part of their property that exceeds this amount within a year of the official establishing of the district. In case they fail to comply they have to sell the excess area to the federal government who will arrange for settlers. Although the construction of many irrigation districts—for example, the Laguna District in the states of Coahuila and Durango, the Culiacan District in Sinaloa, the Lower San Juan River District, and the Lower Rio Bravo District—was begun under the 1926 law, operation, settling, and repayment charges were established under the 1946 law. Some of the irrigation districts do not have settling problems since all the irrigated land is in the hands of either agrarians or original owners in small holdings.

The Lower San Juan River and the Lower Rio Bravo districts are fully occupied. Settlers have been established on lands even before construction was finished, with permission to clear their farms and risk a cotton "temporal" crop. The Agrarian Department has also settled some of the land in the last two mentioned districts with farmers from overcrowded regions like the State of Tlaxcala. In spite of original difficulties, abuses, and some speculation, land is substantially subdivided, as shown by the following data: Out of the 574,127 hectares under cultivation in 1943, 336,113 hectares or 58.6% is in the hands of agrarian interests or settlers with holdings up to 10 hectares; 196,098 hectares or 34.1% belongs to settlers or owners of from 10 hectares to 20 hectares; 32,739 hectares or 5.70% belongs to settlers or owners of from 20 hectares to 50 hectares and only 9,176 hectares or 1.6% represents holdings of more than 50 hectares. It is to be noted that 92.7% of the irrigated land is owned by holders of less than 20 hectares.

It has been stated that it takes three generations of farmers to settle irrigated land. This might even be true in Mexico, although, in various districts that were settled from 1930 to 1935, a good many original settlers still hold the land.

To Improve Settling Policy.—Settling regulations for new regions or districts where integral development is contemplated, like the Papaloapan Project, should be improved so that:

1. Speculation of original landowners who resell at very high prices and thus reduce the settlers' capacity to pay for construction charges can be avoided.
2. True farmers are established as landowners.
3. Uneconomical holdings of less than 5 hectares are readjusted.

GENERAL OPERATION AND MAINTENANCE ASPECTS

The success of irrigation districts generally depends on adequate operation. The term "operation" is used in Mexico in a very broad sense to mean the general managing of the irrigation district—including settling; distribution of water; maintenance of channels, drains, service roads, and structures; as well as agronomical control. Operation in its true sense should include only water distribution, maintenance of irrigation systems, and operation charges.

The National Irrigation Commission was in charge of operation until 1935 when it was turned over to the National Agricultural Bank. By 1937, the commission began to operate some districts where "ejidos" predominated and in 1944 operation by the Commission was reassumed in all irrigation districts. (The King of Spain granted lands called "ejidos" to Indian villages and towns in Mexico. These lands could be used but could not be sold. The Mexican Revolution released these lands to the poor farmer and, in addition, granted other lands to him on similar terms.) Under the 1946 Irrigation Law, operation is entrusted to the Ministry of Agriculture. The Ministry of Hydraulic Resources (formerly the National Irrigation Commission) is supposed to turn over operation to the Ministry of Agriculture as soon as a unit is ready for water delivery. Operation by water users, who eventually will take complete charge, is regulated by law.

Large irrigation districts are operated by the government, and water users are being organized in such a way as to make it possible to turn over to them lateral systems and eventually the whole district. Important structures like multiple-use reservoirs, diversion dams in some cases, and main canals in special cases, will be excepted and will always be controlled by the government. Since small irrigation projects are so numerous, it is economically impossible for the government to operate them; and therefore they are turned over for operation to water users, with some special exceptions, as soon as construction is finished. Regulations are established for water distribution, and periodical inspections check on the operation and maintenance of the district.

Water Distribution.—Water distribution is a very important item of operation. Rules for adequate water distribution have been issued since the beginning of the irrigation program. These regulations are modified as indicated by need or by experience. Since irrigation districts were established in 1930, regulations have set up water users' associations that, among other activities, assist the management to enforce water distribution rules.

As a new development, administrative councils have been organized on which water users and the proper authorities are represented. These councils formulate the annual irrigation schedule and discuss operation charges and general matters in connection therewith.

Different methods of water distribution have been used, such as "continuous service," "rotation among users," "rotation among distributing canals" (especially used in torrential streams where no storage has been constructed), and "free demand." Service on demand was established at the beginning, the only restrictions being that the district was authorized to deliver water in accordance with crop needs and that a number of the water users had to ask for water in any lateral to obtain service.

The demand method resulted in serious inconvenience. Water was wasted because it was necessary to maintain high head on delivery canals. Many people have to be employed to meet the demand requests; and, of course, simultaneous demands are hard to fulfill. Although it was planned as a transitory system, the demand method has been very difficult to change because there always seems to be a reaction against any radical revision of customary procedures.

It has been much easier to enforce good water distribution rules in irrigation districts like Don Martin (Fig. 1(a)), Conchos, or Lower San Juan where the former National Irrigation Commission had designed the subdivision. On the other hand, where land was extensively subdivided into small and irregular holdings and where distribution laterals had to be laid out in connection with property lines or property layout, water distribution became very wasteful and difficult to control.

Maintenance of Canals and Structures.—Good maintenance is of course essential for efficient operation of irrigation districts. Carelessness can result in serious crop losses or in endangering irrigation works or even in failures of canals and structures. A few aspects of this problem will serve as illustrations.

Conduction losses in irrigation ditches have been observed in various districts. Preliminary data show percentage losses of from 1.71% in the Tijuana District (Fig. 2) to 50.08% in the Conchos District as observed during 1939 and 1938, respectively—the Tijuana District being provided with concrete-lined canals. The losses per kilometer of canal run from 0.22% in Tijuana to 1.89% in the east canal of Rio Mante District.

Several methods have been followed for clearing irrigation ditches or drains—drag lines, scrapers, "fresnos," and hand shovels all have been used depending on the size of the canals and the regional cost of labor. Another problem is the vegetation growth in the Conchos main canal. The capacity of the Conchos main canal has been reduced sometimes as much as 65%. This canal was designed with a roughness coefficient n of 0.0225 and the laterals have coefficients of 0.026. Because of the great growth of water weeds the coefficient has been as great as 0.131. Chains have been used to fight the weeds but results have not been entirely satisfactory; disk harrows combined with chains have also been tried as was muddling the water with clay (although not extensively, since salts in the water made the clay coagulate). Commercial chemicals have been found too expensive; and naphtha emulsion has been advised but has not been tested.

Operation Charges.—Operation charges are collected on several bases: Per volume of water used, per irrigated hectare (annually), and per hectare per times of irrigation. Although the volumetric charge is perhaps the best method for

collections since it promotes an economic use of water, it is not very widely used because equipment is required for accurate measurement of the water delivered as well as the good cooperation of water users.

Social, economic, and disciplinary circumstances made it impossible for some time to fix operation charges that would balance expenses. All efforts made by the operating institutions have been aimed at gradually balancing the operation budget. Therefore, the National Irrigation Commission and the Ministry of Agriculture have gradually increased charges, to the point that the government's subsidy for operation is very small.

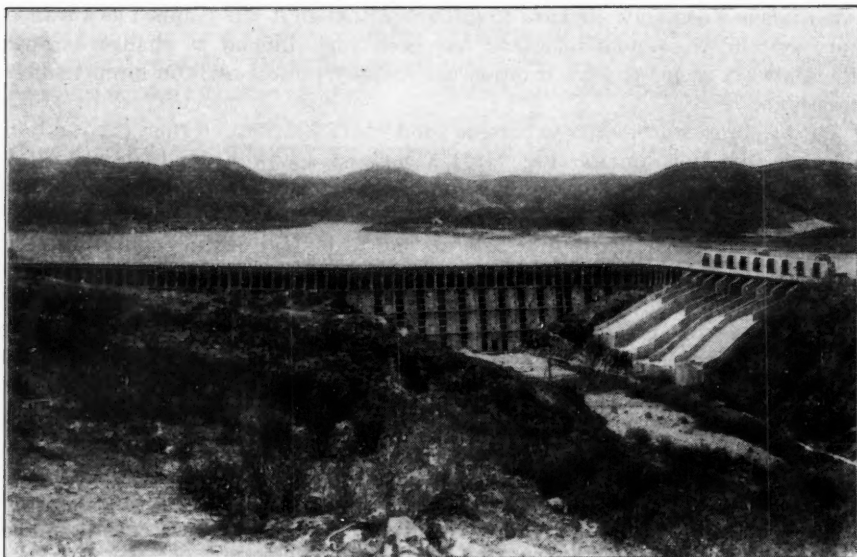


FIG. 2.—MAIN UNIT OF A SUCCESSFUL IRRIGATION PROJECT, ABELARDO RODRIGUEZ DAM, Tijuana District, Lower California

From experience thus far it can be concluded that all irrigation canals and structures should be very carefully observed, particularly for 2 years or 3 years after operation is begun. A special sum should be set aside for maintainance during this period and probably should be charged as "operation during construction." Close coordination should be established between the builders of irrigation systems and the people in charge of operation.

ECONOMIC ASPECTS

Repayment of Cost.—If world-wide experience in irrigation, particularly in the United States and Mexico, is analyzed, it is realized that early irrigation represented the efforts of a community to subsist without any idea of business or gain. Later on, private enterprise tried, without success, to develop irrigation for business purposes. Nowadays irrigation is generally considered as a national project whose purpose is to improve the agricultural and eco-

nomical conditions of rural masses and consequently to benefit the nation as a whole. Several reasons account for this:

1. Irrigation requires the investment of enormous amounts of money. Direct total repayment is almost impossible, with the exception of some projects where a great quantity of hydroelectric power can be developed.

2. Capital invested in irrigation works does not produce returns for a long period depending on the time required for construction, settling, and organization of production.

3. Private enterprise would have to plan irrigation systems to fit definite purposes whereas government projects are planned for multiple and integral uses.

From world-wide experience, as related to Mexican demographic, social, land ownership, and economic conditions, it can be concluded:

- a. Irrigation and drainage works in Mexico have to be developed mainly by the federal government.

- b. Conclusion *a* does not hamper private initiative—especially in the cases of hydroelectric plants, individual pumping projects, cooperative irrigation developments, rural credit companies, industry, and so forth.

- c. Private enterprises should be supervised by the state so that all hydroelectric or irrigation developments fit the national plan and also for the purpose of avoiding undue speculation.

For comparative purposes some items of American experience on repayment of cost of irrigation should be mentioned. Originally it was thought in the United States that a 10-year term would be sufficient for repayment of charges assigned to water users. Soon it became evident that such a period was very short. In 1914 terms were extended to 20 years; in 1924 terms were again extended and other rules were issued to ease payment conditions; and in 1926 the period for repayment was made 40 years. According to John A. Widsoe, by 1922 only 10.9% of construction cost had been paid, although the punctuality index was 85.8%.

Conditions seem to have improved according to a 1947 publication of the Bureau of Reclamation,² United States Department of the Interior, which indicates that 94% of the total investment can be repaid; and of this percentage 21.6% corresponds to contracts signed by water users of irrigation projects and 49.4% corresponds to contracts made with users of electrical energy.

Again, in Mexico, experience concerning repayment or irrigation costs is divided into two periods—that under the 1926 Irrigation Law and that under the 1946 law. The 1926 law provided that landowners of areas with more than 150 hectares should pay the government for the irrigation charge with a part of their land in such a way that they would retain an amount of irrigated land which would have the same value as that of their original total property previous to irrigation. For owners of less than 150 hectares the same law provided that they should pay in the way that would be fixed for each case (generally in annual payments).

² "How Reclamation Pays," Bureau of Reclamation, U. S. Dept. of the Interior, Washington, D. C., 1947.

Because of a number of circumstances, especially the practical impossibility of complying with the process established by the 1926 law (since strict enforcement of procedures would have meant a serious delay), only in exceptional cases was it possible to follow the legal procedure. Also much speculation took place, particularly by original owners. Therefore it was necessary to buy land and, in extraordinary instances, to expropriate it. As soon as lands were ready for settling, a selling price was fixed. The price ran from 60.00 pesos per hectare to 260.00 pesos per hectare to be paid annually with 4% interest on unpaid capital. Terms were from 20 years to 25 years.

During this period irrigation cost per hectare averaged from 500.00 pesos to 700.00 pesos and therefore repayments assigned represented:

Cost per hectare, in pesos:	%
500.00	14 to 52
700.00	10 to 37.2

Prices for irrigated land were lower than actual cost but were graded so that settlers would be able to meet obligations and also so that the increase in public wealth would result in indirect payment of part of the investment.

A general idea of settlers' capability to meet obligations during the early period of operation is presented in Tables 1 and 2. From the study of Table 1 it can be concluded that, for this earlier period:

1. It was almost impossible for settlers to pay 100% of the cost for holdings of less than 20 hectares.
2. It was possible for settlers to pay charges of from 200.00 pesos per hectare to 300.00 pesos per hectare since annual costs would be from 12.80 pesos per hectare to 19.20 pesos per hectare.

By 1945, the 1935 charges were really low if the increase in crop values, shown by Table 2, is considered. Prices for irrigated land were fixed for the Don

Martin, Conchos, Palestina, Pabellon, and Tijuana districts during the first period. By 1943, 41.9% of amounts due for contracted lands had been repaid. The 1946 law radically changed procedures in relation to repayment of cost. It provided that owners of areas greater than 100 hectares must subdivide the excess within a year of the official opening of the irrigation district. If they failed, their excess land must be sold to the government.

TABLE 1.—SETTLERS' RETURNS FOR
IRRIGATION IN MEXICO IN 1935

Size of holding, in hectares	Apparent profit, ^a in pesos	ANNUAL PAYMENT, ^b IN PESOS	
		With 4% interest	Without interest
4	417.48	179.25	112.00
10	1,043.70	448.08	250.00
20	2,087.40	896.17	560.00

^a 50% cotton; 50% wheat. ^b 25-year terms for a cost of 700 pesos per hectare.

There is an irrigation fee generally smaller than the actual irrigation cost on lands remaining in the hands of original owners and on those sold to settlers either by the government or by the original owners. This fee is determined on the basis that commercially irrigated land prices in the neighboring regions

increase through irrigation, because of added productive value of land, and especially because of the farmers' capacity to meet obligations. Before the irrigation charge is officially fixed, the Ministry of Hydraulic Resources hears the opinions of the water users.

This procedure has been established since 1947 and by April, 1949, the irrigation repayment fee was fixed for new units of the Conchos, Rio Culiacan, Bajo Rio Bravo, and Bajo Rio San Juan districts. Legal action has been begun on many others.

The 1948 irrigation charges average from 500.00 pesos per hectare to 700.00 pesos per hectare. The average cost of irrigation per hectare is about 1,500.00 pesos. The charge represents from 33% to 46% of present average cost. The 1948 value of crops is given in Table 2.

A study to be completed is concerned with whether or not the irrigation repayment charge should be considered together with the water charge—that is, whether the volumetric water charge would cover operation cost and construction charges over a certain period of years.

Because farmers recognize the necessity for storage works and because public funds are limited, it has been possible to finance parts of irrigation systems like main canals or distribution systems by direct cooperation from the farmers. In these cases water users either sign contracts for repayment of cost on 2-year or 3-year terms which can be negotiated with some credit institution, or they pledge themselves to buy bonds issued for the special purpose. Water users can use these bonds to pay for contracted obligations of repayment for irrigation works.

Rural Credit in Irrigation Districts.—Although rural credit in irrigation districts is very important, the size and scope of this paper will only allow a general presentation of the problem.

As soon as an irrigation project is opened for settling or for cultivation and when the lands are already subdivided, agricultural, economical, and social work really starts, and complex problems begin to appear. Selection of settlers, rural population redistribution, organization of agricultural production, and choice of crops are among the important problems. Another is rural credit.

According to the special characteristics of the agrarian problem, official banks have two different activities: One strictly as a financial institution, although without profit, and the other as manager and supervisor of agricultural plans. "Ejido" lands are attended to by the National Agrarian Credit Bank and the small holdings are served by the National Agricultural Bank. Credit for special crops like sugar cane and cotton is extended in many cases by

TABLE 2.—INCREASES IN THE
VALUE OF IRRIGATED LANDS
IN MEXICO

Year	Irrigated area ^a	VALUE OF CROPS, IN PESOS	
		Annual	Unit ^b
(1)	(2)	(3)	(4)
1935...	162,266	31,301,549	192.50
1945...	554,214	349,024,533	630
1948...	759,966	637,936,634	840

^a Land in national irrigation, in hectares (1 hectare = 0.404687 acre). ^b Gross value in pesos per hectare (1.00 peso per hectare = 2.471 pesos per acre).

private enterprises and banks. Private capital is also appropriated through the official agricultural banks. In some cases like the Culiacan, Rio Yaqui (Fig. 3), Rio Mayo, Rio Colorado, and Lower California districts, regional credit unions have been organized, in which the farmers are stockholders.



FIG. 3.—PICTURESQUE STRUCTURE IMPOUNDS MAIN RESERVOIR; ANGOSTURA DAM, ON RIO YAQUI IRRIGATION DISTRICT, STATE OF SONORA

Such credit unions, if properly managed, should finally solve the rural credit problem in the irrigation districts.

GENERAL RESULTS OF MEXICAN IRRIGATION

From an agricultural point of view the 1949 increase of more than 1,000,000 hectares and the addition of another 1,000,000 hectares within the succeeding few years should cover the demand for agricultural products in Mexico. Farm production values have been increased from 50% to perhaps 100%. This planned irrigation advance, besides settling some half a million people, thus far has promoted the creation of industries (especially those related to agricultural products) and has encouraged commercial activities. Socially it has improved the living conditions of many thousands of people and has helped redistribute some of the rural population.

AMERICAN SOCIETY OF CIVIL ENGINEERS

OFFICERS FOR 1950

PRESIDENT

ERNEST E. HOWARD

VICE-PRESIDENTS

Term expires January, 1951:

HENRY J. SHERMAN
ROBERT B. BROOKS

Term expires January, 1952:

FRED C. SCOBAY
ALBERT HAERTLEIN

DIRECTORS

Term expires January, 1951: Term expires January, 1952: Term expires January, 1953:

WILLIAM M. GRIFFIN
KIRBY SMITH
FRANCIS S. FRIEL
JULIAN HINDS
WEBSTER L. BENHAM
C. GLENN CAPPEL

WALDO G. BOWMAN
MORRIS GOODKIND
HAROLD L. BLAKESLEE
PAUL L. HOLLAND
EDMUND FRIEDMAN
S. T. HARDING

OTTO HOLDEN
FRANK L. WEAVER
GORDON H. BUTLER
LOUIS R. HOWSON
G. BROOKS EARNEST
WALTER J. RYAN
GEORGE W. LAMB

PAST-PRESIDENTS

Members of the Board

R. E. DOUGHERTY

FRANKLIN THOMAS

TREASURER

CHARLES E. TROUT

EXECUTIVE SECRETARY

WILLIAM N. CAREY

ASSISTANT TREASURER

GEORGE W. BURPEE

ASSISTANT SECRETARY

E. L. CHANDLER

PROCEEDINGS OF THE SOCIETY

SYDNEY WILMOT

Manager of Technical Publications

HAROLD T. LARSEN

Editor of Technical Publications

COMMITTEE ON PUBLICATIONS

WALDO G. BOWMAN

FRANCIS S. FRIEL
S. T. HARDING

OTTO HOLDEN
LOUIS R. HOWSON

KIRBY SMITH